

### HAND HELD LIGHTER

The present invention relates to a hand held lighter. The present invention is particularly concerned with a hand held lighter of the type comprising a fuel container, a fuel valve for allowing fuel to be fed from the fuel container to an ignition point, a lever for opening the fuel valve, a flint and a rotatably mounted sparking wheel contacting the flint, so that when the sparking wheel is rotated, sparks are generated by the flint and projected to the ignition point. In operation, a user will rotate the sparking wheel with their thumb while simultaneously depressing the lever to allow fuel to be fed to the ignition point, where it is ignited by the sparks.

This type of hand held lighter is very well known in the art but concerns have been raised about safety issues relating to simple designs of hand held lighters. In particular, there is a concern that a lighter of this type might be unintentionally ignited whilst being carried, causing a fire hazard. Further, there is a desire to make hand held lighters child resistant to prevent children playing with lighters accidentally creating a fire.

Lighters with safety features are known in the art. For example Chinese patent application number 97219832.6 discloses a child resistant lighter in which it is made relatively difficult for a user's thumb to contact the sparking wheel. This may be achieved by rotatably mounting the sparking wheel with respect to a pair of side wheels, collectively mounted with the sparking wheel and preferably of greater diameter than it. Alternatively, a shield which surrounds the ignition point may be extended upwards and inwards so that the edges of the shield rest above the sparking wheel. In both cases, the user has to press their thumb very firmly between the edges of the shield or the side wheels in order to contact the sparking wheel. The side wheels tend to rotate instead of the sparking wheel. This reduces the possibility of accidental ignition and makes it harder for children to create the necessary sparks to light the lighter.

In Chinese patent application no. 98208691.1, an additional safety feature is disclosed, in which resilient means are placed beneath the part of the lever which is operated by the user. The user has to apply a greater force to the lever in order to release the fuel for ignition. Again, this helps to prevent accidental ignition or ignition by children playing with a lighter.

It is further desired to improve the safety features of a hand held lighter compared to what is known in this prior art.

Conventionally, the side wheels are rotatably mounted with respect to the sparking wheel and have roughened edges so that they are preferentially rotated. The present inventors have realised that, if side wheels are provided which, instead of being rough, are relatively smooth, a user's thumb will slip off the side wheels without contacting the sparking wheel, unless the user applies a sufficient force, sufficiently carefully. This can provide a further safety feature preventing accidental ignition of the lighter. Accordingly, the present invention provides in a first aspect a hand held lighter comprising a fuel container, a fuel valve for allowing fuel to be fed from the fuel container to an ignition point, a lever for operating the fuel valve, a flint, a rotatably mounted sparking wheel contacting the flint, so that when the sparking wheel is rotated by a user, sparks are generated by the flint and projected to the ignition point, at least one side wheel being provided, adjacent to the sparking wheel, wherein the circumferential surface of the side wheel is smooth so that, if a force is applied by a user's thumb or finger to the circumferential surface of the side wheel and the sparking wheel, which force would in the absence of the side wheel be just sufficient to rotate the sparking wheel and generate sparks, the user's thumb or finger will slip on the side wheel.

It is common for the side wheels to be rotatably mounted with respect to the side wheel so that they are preferentially rotated. The present inventors have further realised that additional safety can be provided if the side wheel and the sparking wheel are rigidly mounted so that they rotate together, the side wheels being made small so that the moment of the force applied by a user to the side wheel and sparking wheels is small, making it more difficult to rotate them.

Accordingly, in a second aspect of the invention, there is provided a hand held lighter, comprising a fuel container, a fuel valve for allowing fuels to be fed from the fuel container to an ignition point, a lever for operating the fuel valve, a flint, a rotatably mounted sparking wheel contacting the flint, so that when the sparking wheel is rotated by a user, sparks are generated by the flint and projected to the ignition point, at least one side wheel being provided, rigidly connected to and adjacent to the sparking wheel, wherein the diameter of the side wheel is smaller than the outside diameter of the sparking wheel

The method of using the hand held lighter of the present invention is exactly the same as the prior art. However, a user has to apply a greater force to the side wheel and sparking wheel in order to cause the latter to rotate and generate sparks.

It can be determined if the circumferential surface of a side wheel is smooth enough for the present invention by a number of methods.

The first method is essentially empirical. A user is provided with a lighter according to the invention, having a side wheel, and a lighter substantially identical to the first lighter, except that it has no side wheel. The user is then asked to attempt to light each lighter a number of times. The user is then asked to determine subjectively the force required to ignite the second lighter. The user is then requested to assess whether, if the same force is used with the first lighter, the user's thumb slips for a substantial proportion of attempts to light the first lighter. For example, the proportion may be over half, preferably over two thirds of the attempts, preferably over three quarters of the attempts.

The accuracy of this test may be improved by increasing the number of attempts that the user has to make. It may be further increased by asking a panel of different users to each assess the first and second lighter in the same way. If a substantial proportion of the panel of users considers that the force required to ignite to the second lighter leads to the thumb slipping with the first lighter, the requirement of claim 1 is deemed be met. This proportion may be at least 50%, preferably at least 60% preferably at least 75% of the panel.

Secondly, the circumferential surface of the side wheel may be smooth if it contains substantially no re-entrant formations or protrusions. It is preferred that it is not jagged. For example, it is preferred that there are no upstanding ridges or indented grooves, no roughened parts or jagged edges. Preferably, any protrusions or indentations on the surface do not exceed 0.1mm in depth and preferably do not exceed 0.01mm in depth.

The side wheels are made of any suitable material, for example zinc alloy, stainless steel or brass. The side wheels may be constructed of this material by a method that gives a smooth surface, for example by forming methods such as punching or by die casting. The side wheels may be polished.

The side wheel may be of any suitable shape. Preferably, it is part cylindrical. However, the circumferential sides may define sections of a cone. They may comprise curved sections. For example, the side wheel may be formed with rounded edges. The side wheel is suitably of axial length in the range .5 – 5.0 mm, preferably around 1.0 – 2.0 mm. Preferably, its axial length is in the range .5 to 1.5 times the axial length of the sparking wheel. Preferably, there are two side wheels, one on each side of the sparking wheel.

The sparking wheel and the side wheel or wheels may be mounted on a common axle. Alternatively, they be mounted on separate axles. Alternatively, the side wheels may comprise stub axles projecting from either side thereof, the stub axles being received on one side in a bearing and on the other side in a bearing in the sparking wheel. Preferably, in the first aspect of the invention, the side wheels are substantially fixed with respect to the sparking wheel. This increases the resistance to rotation of the side wheels and the tendency of the user's thumb to slip.

The sparking wheel itself is preferably of conventional design, and details of the design will be well known to the person skilled in the art. It will be made of a suitable material, as will be well known to the person skilled in the art.

In the first aspect of the invention, the diameter of the side wheel may be larger than the outside diameter of the sparking wheel. However, it is preferred that the outer diameter of the side wheel is equal to or less than the outside diameter of the sparking wheel. In this case, (most preferably) the moment of the force exerted by the user's thumb on the side wheel will be smaller, because the radius of application is smaller. This means that the tendency of the user's thumb to rotate the wheel is again less than its tendency to ship.

Preferably, the side wheel or wheels and the spark wheel are mounted in a bracket. The bracket suitably further comprises a mounting for the valve. The valve is preferably operable by a lever, a pivot point being provided in the bracket about which the lever may be rotated to actuate the valve. In this way, as is known in the art of the design of hand held lighters, the operating end of the lever may be mounted so that, in use, it can be contacted by the thumb at the same time as the thumb is used to rotate the sparking wheel, so that the lighter can be operated in a single movement. The part of the lever operable by the thumb will be called the free end. Preferably, resilient means are provided between the free end of the lever and the bracket. The resilient means is provided so that lever can only be operated, and the valve actuated, if sufficient force is applied by the thumb to overcome the resilient means. In this way, extra force is required in order to operate the lighter, providing a further safety feature.

The resilient means may take any suitable form. For example, the bracket may comprise a resiliently deformable projection. Alternatively, a compressible spring may be provided, for example a coil spring, extending between the free end and the bracket. A spring housing may be provided to house the spring.

The hand held lighter preferably comprises a shield. It is well known to provide a shield in hand-held lighters, extending around the ignition point, to prevent leakage of burning fuel from the ignition point and to protect the ignition point from draughts. In a preferred embodiment, the shield extends around the side of the sparking wheel. This provides a further safety feature. The operator has to insert their thumb between respective edges of the shield in order to operate the spark wheel.

The fuel container and shield design may be substantially the same as conventional hand held lighters. The valve may be substantially the same as in conventional hand held lighters. The fuel used may be the substantially the same as used in conventional hand held lighters. The flint may be any suitable flint material used in hand held lighters, and the person skilled in the art will be able to select suitable material.

The side wheel or wheels may be rotationally fixed with respect to the spark wheel or they may be able to rotate freely with respect to one another.

The present invention will be further described by way of example only with reference to the accompanying drawings, in which:

Figure 1 is cross sectional view through the hand held lighter according to the present invention.

Figure 2 is a part section along line A A of figure 1 of the lighter shown in figure 1.

Figures 3, 4, and 5 are illustrations of different embodiments of sparking wheel and side wheels for use in the lighter shown in figure 1.

Figures 6 and 7 show cross sectional views of a different embodiment of lighter according to the present invention

Figures 8 and 9 show cross sectional views of the a third embodiment of lighter according to the present invention.

The lighter shown in figure 1 comprises a fuel container 1, which is shown comprising fuel 2. A wick 3 is provided for allowing fuel to be delivered to a valve arrangement which includes a valve tube 4 movably located with respect to a valve plug 7 and a nozzle 5. The nozzle 5 defines the ignition point for fuel. There is a lever 6 for operating the valve arrangement. The lever 6 has a free end 6a, a pivoting section 6b (visible in figure 2), and a valve operating section 6c which engages an undercut formation formed at the base of nozzle 5. In use, if the free end 6a of the lever 6 is depressed, the lever 6 rotates about its pivot point 6b. This causes the operating section 6c to rise, drawing the nozzle 5 upwards with it. As a result, the valve tube 4 is drawn clear of the valve plug 7 and fuel is fed along the wick 3 from the container 1 and

delivered to the nozzle 5. A spring 8 is provided for returning the valve to its closed position when the lever 6 is released. A sparking wheel 9 is provided. This is formed of a suitable material such as steel. The sparking wheel 9 is formed on its surface with indentations 9a both to allow grip and to ensure a highly frictional contact with a flint 10. The flint 10 is driven into contact with the sparking wheel by a spring 11. In use, the sparking wheel 9 is rotated by a user's thumb in a clockwise direction as seen in figure 1. As a result, sparks are stricken from the top of flint 10 and projected in a direction to the left of the page, towards the nozzle 5, where the sparks ignite the fuel.

As can be seen in figure 2, the sparking wheel is associated with a pair of side wheels 12 and 13. The side wheels will be described further below. However, it can be seen that they each comprise an outer circumferential surface and an axle 14,15. The outer ends of the axles 14 and 15 are retained in a bracket structure 16. The inner ends of the axles protrude into the bearing of the sparking wheel and are rigidly fixed with respect to the sparking wheel. In this embodiment, the sparking wheel and the side wheels 12 and 13 are coaxially mounted in the bracket structure 16.

A shield 17 is provided for protecting the nozzle 5. The shield is formed of metallic plate material and extends around the sparking wheel and the end of the nozzle. It can be seen that, the top edges of the shield 18 are bent over the top of the bracket structure 16 and abutt the sides of the side wheels 12 and 13 in figure 2.

Finally, a spring 19 mounted on a spring shaft 20 is provided. The end of the spring shaft 20 is urged against the free end 6a of the lever 6 biasing the free end into the upper position.

In use, a user places their thumb in contact with the sparking wheel 9 and, simultaneously, in contact with the free end 6a of the lever 6. If sufficient force is applied, the spring force of the spring 19 is overcome and the lever 6 is depressed, operating the valve 4 so that fuel is fed to the nozzle 5. Simultaneously, the sparking wheel is rotated and sparks are stricken from the end of the flint 10 to ignite the fuel. In order to prevent inadvertent operation of the lighter or to prevent operation of the lighter by children, the spring force 19 is made sufficiently large. Further, the circumferential

edges of the side wheels 12 and 13 are made smooth. That is, they are constructed with a smooth surface and without projections or indentations which would affect frictional grip of the user's thumb.

In use, if a user applies a force which would normally, in the absence of the side wheels 12 and 13 just be sufficient to rotate the sparking wheel 9 and strike sparks from the flint 10, the smoothness of the side wheels 12 and 13 is such that the user's thumb will slip. In order to use the lighter, the user has to apply a larger force. This makes inadvertent operation of the lighter or operation by children difficult.

As shown in figure 2 and figure 3, according to one embodiment of the first aspect of the invention, and as required by the second aspect, the side wheels 12 and 13 are of smaller diameter than the sparking wheel 9. The sparking wheel 9 therefore stands proud of the side wheels making contact easier. However, the safety is not lost, due to the smoothness of the circumferential surfaces of the side wheels. The moment of the force exerted by the user's thumb on the sidewheels is less, because of their lower diameter, increasing the tendency to slip.

However, in a second embodiment of the first aspect of the invention, side wheels 21 and 22 may be provided which are of the same radius as the sparking wheel 9, as shown in figure 4. Moreover, side wheels 23 and 24 may be provided which are of greater radius than the sparking wheel 9, as shown in figure 5. These make the sparking wheel harder for the user to contact with their thumb providing a further level of safety. The user has to press even harder with the thumb in order to ensure that the thumb enters the gap between the side wheels 23 and 24 to operate the sparking wheel 9.

Figure 6 shows a schematic cross section of a hand held lighter which is substantially the same as shown in figure 1 accept that the shield 25 extends to the same level as the outside of the sparking wheel, thereby presenting a further safety feature. In use, the user has to press their thumb firmly against the edges of sparking wheel 9 in order to rotate it to cause sparks. Figure 7 shows a cross section along line B-B of figure 6.



Figure 8 shows a yet further design of hand held lighter according to the present invention. It is substantially the same as the hand held lighter of figures 1 and 6, except that the shield 26 extends around the side wheels and the sparking wheel 9 and stands slightly above them, as can be seen in figure 9, which is cross section along the line C-C of figure 8. This provides a yet further safety feature. The user has to press their thumb particularly carefully and firmly into the gap between the ends of the shield 26 in order to contact the sparking wheel 9 with sufficient force to rotate it.

The present invention has been described above purely by way of example and modifications can be made within the spirit of the invention, which extends to equivalents of the features described. The invention also consists in any individual features described or implicit herein or shown or implicit in the drawings or any combination of any such features or any generalisation of any such features or combination.